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Increase in XUV opacity of Al due to shock compression*

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The possibilities opened up by XUV laser radiography of laser ablated thin foil targets were discussed at the previous conference in this series and it was suggested that there was potential for resolving imprinted perturbations in mass per unit area of small amplitude and short wavelength,which are of importance for the stability of laser driven implosions in fusion research and arise from laser speckle [1]. Experimental results were subsequently obtained and published [2,3].

It was also suggested that changes in opacity due to shock compression would be measurable with good accuracy due to the possibility of observing very high attenuation factors and that this might provide an interesting test of opacity models in a regime where the plasma was strongly coupled and degenerate. This aspect has recently been explored using small irradiated area on a thin foil aluminum target and radiographing a larger region with a 19.6 nm Ge XXIII XUV laser, to observe directly the change in transmission where the material is shocked. The time resolved thickness averaged opacity change when the foil is subjected to a 3 Mbar shock shows the increase as the shock progresses through the foil followed by a relaxation as the foil decompresses in flight.

Modelling of this behaviour suggests that the opacity change is mainly associated with the degeneracy correction to inverse Bremsstrahlung absorption. These measurements and their interpretation will be discussed.

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